Verification of the thermal buckling load in plates made of functional graded materials

Abstract

In this study, thermal buckling of thin plate made of Functionally Graded Materials (FGM) with linearly varying thickness is considered. The material properties are also graded in the thickness direction according to a simple power law distribution in which the properties are stated in terms of the volume fractions of the constituents. All edges of the plate are simply supported. The equilibrium and stability equations of a FGM plate under thermal loads can be derived based on higher order plate theories via variation formulation, and are then used to determine the governing deferential equation of the plate and the pre-buckling forces. The buckling analysis of a FGM plate is conducted by assuming a uniform temperature rise, temperature gradient through the thickness, and linear temperature variation in the thickness. Closed–form solutions are obtained the buckling load defined in a weighted residual approach. In a special case the obtained results are compared with the results of FGM plates with uniform thickness. The influences of the plate thickness variation and the edge ratio on the critical loads are investigated. Different gradient exponent k, different geometries and loading conditions were studied.